

What is claimed is:

1. A battery pack including at least a battery cell and a protection circuit for shutting off overcurrent discharge, comprising:

shut-off holding means for holding the discharge shut-off condition  
5 after abnormal discharge shut-off due to shorting or connection of a low resistance between the external plus terminal and the external minus terminal of the battery pack; and

releasing means for releasing the shut-off by the shut-off holding means by applying a predetermined voltage between the external plus  
10 terminal and the external minus terminal of the battery pack.

2. The battery pack as cited in claim 1, wherein

said shut-off holding means is a resistor block of 1 k $\Omega$  or larger connected between a battery cell positive terminal in the battery pack and  
15 the external minus terminal.

3. The battery pack as cited in claim 1, wherein

said releasing means is a detector disposed between the external plus terminal and the external minus terminal for detecting the application of a  
20 predetermined voltage between the both terminals.

4. A battery pack including at least a battery cell and a protection circuit for shutting off overcurrent discharge, wherein

said protection circuit comprising:  
25 shut-off holding means of a resistor block of 1 k $\Omega$  or larger connected between a battery cell positive terminal and an external minus terminal; and  
a detector for detecting voltage between an external plus terminal and the external minus terminal; wherein

abnormal discharge by shorting or connecting a low resistance  
30 between the external plus terminal and the external minus terminal of the battery pack is shut off, and such discharge shut-off is maintained by the

shut-off holding means; and

the discharge shut-off is released to recover discharge upon detecting by the detector the application of a predetermined voltage between the external plus terminal and the external minus terminal of the battery pack.

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5. The battery pack as cited in claim 3, wherein

said detector is one of a charger detector, a voltage detector, a voltage change detector, an A.C. resistance detector, and a voltage dropper.

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6. The battery pack as cited in claim 3, wherein

said detector is connected to one of a differentiation circuit, and an one-shot circuit.

7. The battery pack as cited in claim 1, wherein

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said discharge shut-off by the shut-off holding means is made by a discharging control switch connected between the battery cell negative terminal and the external minus terminal.

8. The battery pack as cited in claim 1, wherein

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said discharge shut-off by the shut-off holding means is made by a discharging control switch connected between the battery cell positive terminal and the external plus terminal.

9. The battery pack as cited in claim 7 or 8, wherein

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said discharging control switch is one of a mechanical switch, a transistor, and a field effect transistor.

10. The battery pack as cited in claim 1, wherein

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one of a capacitor, and a voltage smoother is connected between the external plus terminal and the external minus terminal.

11. The battery pack as cited in claim 1, wherein

one of a capacitor, and a voltage smother is connected between the external plus terminal and the external minus terminal, and

in case of a circuit configuration where the discharging control switch  
5 is connected to the battery minus terminal, a resistor is connected between the external minus terminal and the voltage supply terminal for returning overcurrent shut-off or the overcurrent voltage detection terminal of the control IC in the protection circuit, or alternatively in the circuit configuration in which the discharging control switch is connected to the  
10 battery plus terminal, a resistor is connected between the external plus terminal and the voltage supply terminal for returning overcurrent shut-off or the overcurrent voltage detection terminal of the control IC in the protection circuit.

15 12. The battery pack as cited in claim 1, wherein

a p-channel field effect transistor, a resistor and a capacitor are provided as the releasing means for releasing overcurrent discharge shut-off; the drain terminal of the p-channel field effect transistor and the switch control terminal of the discharging control switch are connected;

20 the source terminal of the p-channel field effect transistor and the external plus terminal are connected;

a resistor is connected in parallel between the source and gate terminals of the p-channel field effect transistor; and

a capacitor is connected between the gate terminal of the p-channel  
25 field effect transistor and the external minus terminal.

13. The battery pack as cited in claim 1, wherein

a PNP junction transistor, a resistor and a capacitor are provided as the releasing means for releasing overcurrent discharge shut-off;

30 the collector terminal of the transistor and the switch control terminal of the discharging control switch are connected;

the emitter terminal of the transistor and the external plus terminal are connected; and

a resistor having a resistance value of  $0\ \Omega$  or larger and a capacitor are connected in series between the base terminal of the transistor and the  
5 external minus terminal.

14. The battery pack as cited in claim 1, wherein

an n-channel field effect transistor, a resistor and a capacitor are provided as the releasing means for releasing overcurrent discharge shut-off;

10 the drain terminal of the n-channel field effect transistor and the switch control terminal of the discharging control switch are connected;

the source terminal of the n-channel field effect transistor and the external minus terminal are connected;

a resistor is connected in parallel between the source and base  
15 terminals of the n-channel field effect transistor; and

a capacitor is connected between the gate terminal of the n-channel field effect transistor and the external plus terminal.

15. The battery pack as cited in claim 1, wherein

20 an NPN junction transistor, a resistor and a capacitor are provided as the releasing means for releasing overcurrent discharge shut-off;

the collector terminal of the transistor and the switch control terminal of the discharging control switch are connected;

25 the emitter of the transistor and the external minus terminal are connected; and

a block of a series connection of a resistor having a resistance value of  $0\ \Omega$  or larger and a capacitor are connected between the base terminal of the transistor and the external plus terminal.

30 16. The battery pack as cited in claim 1, wherein

an inductor, a first capacitor, a second capacitor, and a diode are

provided as the releasing means for releasing overcurrent discharge shut-off;  
the inductor and the first capacitor are connected in series;  
the other end of the inductor is connected to the external plus  
terminal;

5 the other end of the first capacitor is connected to the external minus  
terminal;

the second capacitor is connected to the junction of the inductor and  
the first capacitor;

10 the other end of the second capacitor and the anode of the diode are  
connected in series; and

the cathode of the diode is connected to the switch control terminal of  
the discharging control switch.

17. The battery pack as cited in claim 1, wherein

15 an inductor, a first capacitor, a second capacitor, and a diode are  
provided as the releasing means for releasing overcurrent discharge shut-off;  
the inductor and the first capacitor are connected in series;  
the other end of the first capacitor is connected to the external plus  
terminal;

20 the other end of the inductor is connected to the external minus  
terminal;

the second capacitor is connected to the junction of the inductor and  
the first capacitor;

25 the other end of the second capacitor and the cathode of the diode are  
connected in series; and

the anode of the diode is connected to the switch control terminal of  
the discharging control switch.

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